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ning of each regular issue of the PCT Gazette.

(54) Title: **ELASTOGRAPHY DEVICE AND METHOD FOR DETERMINING AND IMAGING OF MECHANICAL AND ELASTIC PARAMETERS OF AN EXAMINATION OBJECT**

(57) Abstract: The present invention relates to a device for determining mechanical, particularly elastic, parameters of an examination object, comprising a) at least one arrangement for determining the spatial distribution of magnetic particles in at least one examination area of the examination object, comprising a means for generating a magnetic field with a spatial profile of the magnetic field strength such that there is produced in at least one examination area a first part-area having a low magnetic field strength and a second part-area having a higher magnetic field strength, a means for detecting signals which depend on the magnetization in the examination object, particularly in the examination area, that is influenced by a spatial change in the particles, and a means for evaluating the signals so as to obtain information about the, in particular temporally changing, spatial distribution of the magnetic particles in the examination area; and b) at least one means for generating mechanical displacements, in particular oscillations, at least in and/or adjacent to the examination area of the examination object. The invention furthermore relates to a method for determining mechanical and/or physical parameters of an examination object, in particular using a device according to the invention. The invention further relates to magnetic particle compositions that can be used in that method according to the invention.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB2004/050445

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B8/08 A61N2/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61B A61N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2001/012915 A1 (MASSENGILL R KEMP ET AL) 9 August 2001 (2001-08-09) abstract; figures 1-3,7,8 paragraphs [0011] - [0014], [0039], [0040], [0044], [0060], [0062] -----	1,2,5
X	EP 0 708 340 A (MAYO FOUNDATION) 24 April 1996 (1996-04-24) cited in the application abstract; figures 1,3,7A-B page 6, line 44 - page 7, line 36 page 9, lines 1-9 page 7, line 41 - page 8, line 3 -----	1-4,7
X	US 6 486 669 B1 (DARGATZ MICHAEL W P ET AL) 26 November 2002 (2002-11-26) abstract; figures 1,2 column 3, line 30 - column 4, line 21 ----- -/--	1.2.7

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>DUTT V ET AL: "Acoustic shear-wave imaging using echo ultrasound compared to magnetic resonance elastography" ULTRASOUND IN MEDICINE AND BIOLOGY, NEW YORK, NY, US, vol. 26, no. 3, March 2000 (2000-03), pages 397-403, XP004295527 ISSN: 0301-5629 the whole document</p> <p>-----</p>	1-9
A	<p>MIGA MICHAEL I: "A new approach to elastography using mutual information and finite elements." PHYSICS IN MEDICINE AND BIOLOGY, vol. 48, no. 4, 21 February 2003 (2003-02-21), pages 467-480, XP002292224 ISSN: 0031-9155 abstract; figures 1-6 pages 467-469</p> <p>-----</p>	1-9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2004/050445

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 10-20
because they relate to subject matter not required to be searched by this Authority, namely:
Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-9

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.1

Claims Nos.: 10-20

Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-9

Device for determining mechanical parameters of an examination object.

A contribution to the art seems to reside in the feature of an ultrasound source (claim 3)

2. claims: 21-30, 32

Magnetic gas bubble composition.

A contribution to the prior art might reside in the features of magnetic particles present at the interface of a gas bubble and a liquid medium.

3. claim: 31

Elastic magnetic particle composition.

A contribution to the art might reside in the feature of the average distance between the magnetic particles in an elastic medium.

4. claims: 33-34

Magnetic particle composition.

A contribution to the prior art might reside in the features of the step change of the magnetization curve.

INTERNATIONAL SEARCH REPORT

International Application No
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2001012915 A1	09-08-2001	US 6208884 B1	27-03-2001
		US 5842986 A	01-12-1998
		CA 2337429 A1	15-06-2002
		US 2002115925 A1	22-08-2002
		US 2002151779 A1	17-10-2002
		US 2002077537 A1	20-06-2002
		US 2001029329 A1	11-10-2001
		CA 2258268 A1	31-12-1997
		EP 0917441 A1	26-05-1999
		JP 2001504714 T	10-04-2001
		WO 9749334 A1	31-12-1997
EP 0708340 A	24-04-1996	US 5592085 A	07-01-1997
		DE 69524839 D1	07-02-2002
		DE 69524839 T2	12-09-2002
		EP 0708340 A1	24-04-1996
		JP 3130236 B2	31-01-2001
		JP 8206097 A	13-08-1996
		US 6037774 A	14-03-2000
		US 5977770 A	02-11-1999
		US 5825186 A	20-10-1998
		US 5952828 A	14-09-1999
US 6486669 B1	26-11-2002	DE 19952880 A1	14-12-2000
		WO 0070362 A1	23-11-2000
		EP 1095289 A1	02-05-2001
		JP 2002543952 T	24-12-2002